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PETERSON CREEK AND LAKE SYSTEM
STEELHEAD EVALUATION, 1989¹

By

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ABSTRACT

Peterson Creek, approximately 40 kilometers north of downtown Juneau, has the most important steelhead *Oncorhynchus mykiss* sport fishery on the Juneau roadside. Efforts to enhance and monitor this fishery date to 1961, but little information on catch and escapements are available. A study of this fishery was initiated in 1989 to enumerate escapement, estimate angler harvests, and collect basic length, weight, and age information.

The 1989 escapement of steelhead counted through the weir at Peterson Creek totaled 222 fish, 103 of which were sampled for sex, length, and weight. Sex composition in the escapement was 69 female (67.0 percent, standard error = 0.05) and 34 male (33.0 percent, standard error = 0.05). Average length of the females (776.1 mm, standard error = 1.0) was larger than the males (762.8 mm, standard error = 2.2). Male and female steelhead had a similar length-weight relationships. The escapement began on May 2, peaked on May 14 1989, and tended to coincide with high water events. A total of 165 steelhead were passed downstream through the weir before June 4, 1989, when the weir was pulled.

An estimated 2,121 angler hours (standard error=200) were expended to harvest 22 steelhead (standard error = 7.35) and to catch and release another 17 steelhead (standard error = 15.6). An estimated 457 Dolly Varden *Salvelinus malma* were caught and released (standard error = 214) while another 181 were harvested (standard error = 42.0). All of the estimated 212 (standard error = 171) cutthroat *Oncorhynchus clarki* caught were released, and 10 (standard error = 4.1) of the 32 rainbow *Oncorhynchus mykiss* caught were kept during the creel survey.

KEY WORDS: Steelhead, *Oncorhynchus mykiss*, escapement, weir, Dolly Varden, *Salvelinus malma*, cutthroat trout, *Oncorhynchus clarki*, creel survey, Peterson Creek, Juneau, southeast Alaska, AWL, Age-Weight-Length, rainbow trout, harvest

INTRODUCTION

The Peterson Creek and Lake system presently supports the most important steelhead *Oncorhynchus mykiss* and resident rainbow trout *O. mykiss* fishery on the Juneau roadside (Schwan 1990). The Peterson Creek and Lake system (Figure 1) has received much local attention and attempted fisheries modification. The lake was treated in 1961 with rotenone in an attempt to eliminate the resident population of Dolly Varden *Salvelinus malma*. After the 1961 treatment, 14,300 steelhead fry from Eva Lake were stocked in Peterson Lake, followed by annual stocking from 1962 through 1968 with steelhead fry from a variety of sources (Table 1). The rotenone treatment was deemed only a partial success when in 1964, sampling revealed that Dolly Varden comprised 50% of the Peterson Lake fish population. Peterson Creek was used as a source of steelhead eggs for the Snettisham Hatchery from 1983 to 1987 (Table 2).

A U.S. Forest Service recreational cabin at Peterson Lake supports hikers and fishermen and is accessed via a recently improved 4 mile trail. State land acquisitions at the mouth of Peterson Creek are also expected to further improve access and increase angler effort.

Very little is known about the magnitude of the escapement, the age and size composition of the escapement, or angler effort and harvest of the steelhead stocks in the Peterson system. The objectives of the 1989 research efforts were to:

1. Count the annual escapement of steelhead into the Peterson system between March 13 and June 4.
2. Estimate the sport angler effort, harvest, and release of steelhead in the Peterson system between March 13 and June 4.
3. Estimate the length and weight composition of the adult steelhead returning to Peterson Creek between March 13 and June 4.

METHODS

Adult Escapement

Steelhead were counted as they passed up or downstream through an aluminum channel and picket weir erected 100 m above a salt lagoon at the mouth of Peterson Creek (Figure 1). Water temperature and depth were taken each morning and at other times when steelhead were passed through the weir. Depth was recorded to the nearest 0.5 cm and water temperature to the nearest °C. Due to the small expected escapement (75-225 steelhead), only about half of the fish passing through the weir were sampled to reduce handling stress on the population. Steelhead were sampled for length, weight, and scales (ages). Fish were immobilized before sampling with an electroshocking basket (Gunstrom and Bethers 1985). All sampled steelhead were measured to the nearest 1 mm of fork length (tip of snout to fork of tail), and weighed to the nearest gm. Date, time of passage through weir, sample number, sex (if possible), condition, and comments, were also recorded. Three scales were collected from an area two scale rows above the lateral line on a diagonal line from the posterior end of the dorsal fin to the anterior end of the anal fin. Scale samples were mounted on gum cards and triacetate impressions of the scales (7,000 kg/cm² pressure at a

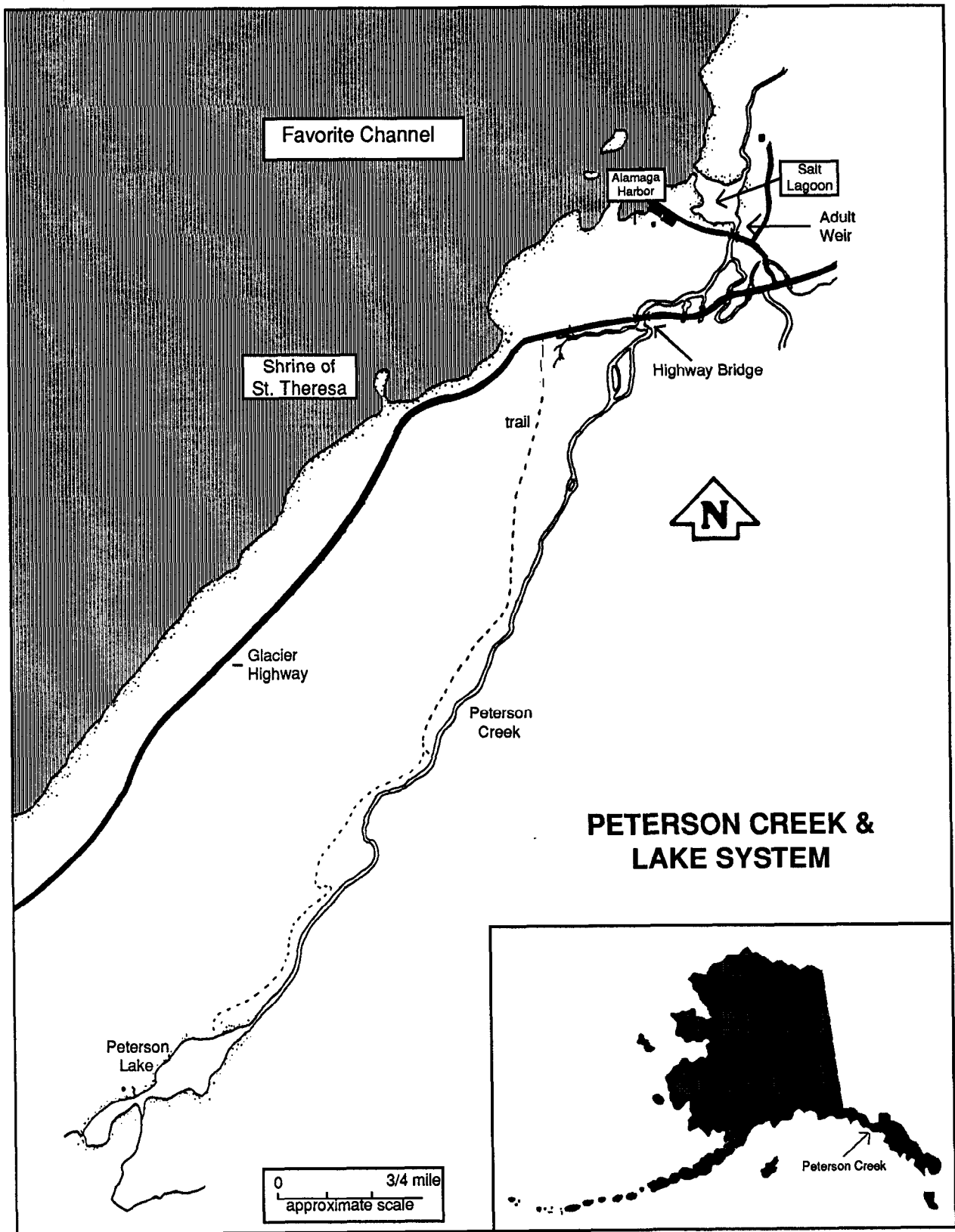


Figure 1. The Peterson creek and lake system near Juneau, Alaska.

Table 1. Numbers of fish stocked into the Peterson Creek/Lake system.^a

Date	Species	Number	Size/Stage	Source
1919	pink salmon	3,300,000	eyed eggs	NA ^b
6/17/41	steelhead	8,600	eyed eggs	Ward Lake
6/17/41	steelhead	10,000	eyed eggs	Ward Lake
1960-62	grayling	NA	eyed eggs	NA
8/10/61	steelhead	14,300	Fry	Lake Eva
8/12/61	steelhead	4,615	Fry	Lake Eva
8/08/62	steelhead	6,500	1,100/lb	NA
7/30/63	steelhead	21,028	1,865/lb	NA
8/07/64	steelhead	17,388	700/lb	Pleasant Bay
8/??/66	steelhead	17,000	1,200/lb	NA
8/??/66	steelhead	17,000	700/lb	NA
8/??/67	steelhead	17,000	800/lb	NA
1968	steelhead	12,000	NA	NA

^a Source unpublished data in ADF&G, Division of Sport Fish, Region I Catalog and Inventory files, Juneau Alaska.

^b Not Available.

Table 2. Number and sex of steelhead removed from Peterson Creek to be used as a brood source for Snettisham Hatchery 1983 to 1987.^a

Sex	Year				
	1983	1984	1985	1986	1987 ^b
Male	3	4	10	11	8
Female	5	4	10	11	8
Total 8	8	20	22	16	

^a Source unpublished data in ADF&G, Division of Sport Fish, Region I Catalog and Inventory files, Juneau Alaska.

^b All but 1 male were live spawned in 1987.

temperature of 97°C for 30 seconds) were prepared for use in determining age. Both scales and otoliths were collected from all steelhead mortalities observed in the stream or in the creel survey so that ages determined from otoliths could be compared to ages obtained from scale samples.

Fultons condition factor (K) for each fish was calculated using the formula:

$$K = \frac{1,000 \times \text{Weight (gm)}}{\text{Fork Length (cm)}^3} \quad (1)$$

The sex composition of the sampled population was determined by calculating the proportions:

$$\hat{p}_i = \frac{y_i}{n} \quad (2)$$

where:

\hat{p}_i = the proportion of steelhead that are male or female;
 y_i = the number of steelhead sampled that are male or female; and
 n = the total number of steelhead sampled.

An unbiased estimate of the variance of this proportion is:

$$V[\hat{p}_i] = \frac{\hat{p}_i(1-\hat{p}_i)}{n-1} \quad (3)$$

The mean and standard error for the length, weight, and condition factor estimates were calculated using standard statistical procedures.

A logarithmic transformation of the length and weight data was made prior to performing a simple linear regression of weight on length. Regression analyses were performed on male and female steelhead individually and combined. Comparison of the two individual regressions was made following methods described by Neter and Wasserman (1974, p. 164) to determine whether the data for male and female steelhead could be pooled. The statistic used to test the hypothesis of equal slopes and equal intercepts is:

$$F^* = \frac{\left(\frac{SSE(R) - SSE(F)}{(n_m + n_f - 2) - (n_m + n_f - 4)} \right)}{\left(\frac{SSE(F)}{(n_m + n_f - 4)} \right)} \quad (4)$$

where:

n_m, n_f = number of observations on males and females, respectively,
 $SSE(R)$ = Error sum of squares for regression with combined data,
 $SSE(F)$ = $SSE_m + SSE_f$
 SSE_m = Error sum of squares for regression on male steelhead,
 SSE_f = Error sum of squares for regression on female steelhead.

If $F^* \leq F_{(\alpha, n, d)}$ ($\alpha=0.95$, $n=2$, $d=98$) then the hypothesis of equal slopes and intercepts is accepted.

Harvest Studies

A roving type creel survey (Neuhold and Lu 1957) with a modified random sampling design was used to estimate total angler effort and harvest at Peterson Creek between March 13 and June 4, 1989. Sampling was stratified by 14-day periods (6 levels) and by type of day (i.e. weekday or weekend/holiday). There are thus 12 distinct strata. Each fishing day was defined as the average number of daylight hours (± 0.25 hrs) between sunrise and sunset in the 14-day strata. Sampling periods within days were defined to be two hours in length. There are thus 6 to 8 possible sampling periods per day depending on the length of days in the strata. Primary sampling units are considered to be 2-hour periods and secondary sampling units are anglers within periods.

Two randomly selected periods per day in all but two contiguous days per calendar week (Monday-Sunday) were selected for sampling. This was considered to be a simple random sample of possible periods in the strata. Periods to sample in each day were selected by either counting forward or backward from the first or last 2-hour period (respectively), to randomly selected period numbers.

During each period selected for sampling, anglers were counted once while walking through the fishery. The "counts" were considered to be instantaneous measures of fishing effort at the time of the count (Von Geldern and Tomlinson 1973). During the same sampling periods anglers were also interviewed to obtain catch per unit effort (CPUE) and release per unit effort (RPUE) for steelhead and other species. During each interview anglers were asked how many hours they fished, whether their trip was complete or incomplete, and the number of fish they caught and kept or caught and released, by species. All harvested steelhead observed in the survey were sampled as described for adult escapement.

Angler effort in each stratum is estimated:

$$\hat{E}_h = R_h \frac{\sum_{i=1}^{d_h} x_{hi}}{d_h} \quad (5)$$

where R_h is the total number of hours available for fishing in stratum h , x_{hi} is the number of anglers counted in sample i stratum h , and d_h is the number of "count" samples taken in stratum h . The variance of E_h is estimated:

$$\hat{V}(\hat{E}_h) = (1-f_h) R_h^2 \frac{\sum_{i=1}^{d_h} (x_{hi} - \bar{x}_h)^2}{d_h(d_h-1)} \quad (6)$$

where \bar{x}_h is the mean number of anglers counted ($\bar{x}_h = \sum_{i=1}^{d_h} x_{hi} / d_h$), f_h is the sampling fraction (d_h/D_h) in stratum h , and D_h is number of possible samples.

Total catch (or harvest) in each stratum is estimated:

$$\hat{H}_h = \hat{E}_h \hat{T}_h \quad (7)$$

where \hat{T}_h is the estimated catch (or harvest) per unit effort in stratum h .

Catch or harvest rates (CPUE or HPUE) in each stratum are estimated:

$$\hat{T}_h = \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{o_i} c_{hij}}{\sum_{i=1}^{d_h} \sum_{j=1}^{o_i} e_{hij}} \quad (8)$$

where c_{hij} and e_{hij} are the catch and effort of angler j sample i stratum h , and o_i is the number of anglers interviewed in sample i . The number of interview samples and the number of "count" samples are the same (d_h) since counts were taken once during each sample period. Both complete- and incomplete-trip interview data were used to calculate CPUE if mean CPUE's for the two types of interviews were not different using an independent samples t-test ($\alpha = 0.05$). The variance of \hat{H}_h is estimated:

$$\hat{V}_h(\hat{H}_h) = \hat{E}_h^2 \hat{V}_h(\hat{T}_h) + \hat{T}_h^2 \hat{V}_h(\hat{E}_h) - \hat{V}_h(\hat{E}_h) \hat{V}_h(\hat{T}_h) \quad (9)$$

after a formula in Goodman (1960) for a product of two independent random variables. The variance of the CPUE or (HPUE) is estimated:

$$\hat{V}_h(\hat{T}_h) = \left(\frac{\bar{c}_h}{\bar{e}_h} \right)^2 \left(\frac{s_{(c)h}^2}{\bar{c}_h^2} + \frac{s_{(e)h}^2}{\bar{e}_h^2} - \frac{2 \text{cov}(c, e)_h}{\bar{c}_h \bar{e}_h} \right) \quad (10)$$

after a formula in Jessen (1978, p.128) for a ratio of random variables. \bar{c}_h is the overall mean catch per angler ($\bar{c}_h = \sum_{i=1}^{d_h} \bar{c}_{hi} / d_h$, $\bar{c}_{hi} = \sum_{j=1}^{o_i} c_{hij} / o_i$) in stratum h , \bar{e}_h is the same statistic for effort, and $s_{(c)h}^2$, $s_{(e)h}^2$, and $\text{cov}(c, e)_h$ are variances and covariance for estimating catch and effort components of the CPUE (or HPUE) using a modified two-stage sampling estimator (Cochran 1977):

$$s_{(c)h}^2 = (1-f_h) \frac{\sum_{i=1}^{d_h} (\bar{c}_{hi} - \bar{c}_h)^2}{d_h(d_h-1)} + \frac{1}{D_h d_h} \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{o_i} (c_{hij} - \bar{c}_{hi})^2}{o_i(o_i-1)} \quad (11)$$

$$\text{cov}(c, e)_h = (1-f_h) \frac{\sum_{i=1}^{d_h} (\bar{c}_{hi} - \bar{c}_h)(\bar{e}_{hi} - \bar{e}_h)}{d_h(d_h-1)} + \frac{1}{D_h d_h} \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{o_i} (c_{hij} - \bar{c}_{hi})(e_{hij} - \bar{e}_{hi})}{o_i(o_i-1)} \quad (12)$$

and $s_{(e)h}^2$ is calculated by substituting e for c in equation 11.

Equation 11 shows that a modified two-stage estimator is used even though the sampling design is more accurately a stratified random design (we define sampling periods as primary units and anglers as secondary units). Variance equations 11 and 12 do not include a finite population correction factor for sampling anglers within periods since the anglers are a random component in the model.

Harvest and effort for the season (and their variances) are the sums across strata $\sum H_h$ and $\sum V[H_h]$, and $\sum E_h$ and $\sum V[E_h]$.

HPUE or CPUE estimates across strata were obtained by dividing the total estimated catch by the total estimated effort:

$$CPUE = \frac{\sum_{h=1}^q \hat{R}_h}{\sum_{h=1}^q \hat{E}_h} \quad (13)$$

where q is the number of stratum to be combined.

Approximate 95% confidence intervals (C.I.) are obtained for harvest and effort estimates by assuming normality. The C.I. for harvest (or effort) is:

$$C.I. = \hat{R} \pm 2 (\hat{V}(\hat{R}))^{1/2} \quad (14)$$

The lower CI is set equal to the value obtained by equation 14, or to the actual number of fish observed in the sampled harvest, whichever is greater. Since the harvest and effort estimates may not be normal, CI limits should be considered approximate.

RESULTS

Adult Escapements

Persistent ice and cold weather delayed completion of the weir until April 22. The weir was then operated continuously for 2 days and 3 biweekly periods until June 4. A dive and foot survey of the stream system above the weir was conducted after the weir was operational and no fish were observed upstream of the weir. A total of 222 steelhead were counted upstream through the weir between May 2 and June 4, with the peak of the escapement occurring on May 14 (Appendix A1 and Figure 2). A high water event seemed to trigger initial movement upstream. Each subsequent major increase in the number of fish passing through the weir coincided with high water events in Peterson Creek (Figure 3).

Of the 222 steelhead passed upstream, 103 fish (46.3%) were sampled for length and weight (Appendix A2). The samples included 69 (67%, SE=0.05) female steelhead and 34 (33.0%, SE=0.05) males. The length frequency distribution for male and female steelhead sampled was very similar (Figure 4); females averaged 776.1 mm (SE=1.0) in length, and males averaged 762.8 mm (SE=2.2) (Table 3). The female steelhead sampled at the weir averaged 4,732.2 g (SE=19.3) in weight and the males 4,505.2 g (SE=36.0). The mean condition factor of steelhead sampled at the weir was 1.01 (SE=0.0022) for females and 0.99 (SE=0.0025) for males (Table 3).

No significant difference between the slopes and intercepts of regressions for male and female steelhead was found ($F^*=1.13 \leq F_{(.95,2,120)}=3.07$). Therefore the length and weight data from male and female steelhead were combined in the regression analysis. The estimated length-weight parameters for the 103 steelhead sampled at the weir during 1989 were: $a = -10.781$, $SE(a) = 0.089$; $b = 2.8903$, $SE(b) = 0.097$; correlation (a,b) = 0.90 (Figure 5).

A total of 165 steelhead were also counted as they moved downstream to leave Peterson creek after spawning (Appendix A3). The first 6 fish passed down through the weir on May 15, and the peak of downstream migration occurred on May 24 (Figure 3). The downstream count was 74.3% of the upstream count, but steelhead were still leaving the system when the weir was removed on June 4.

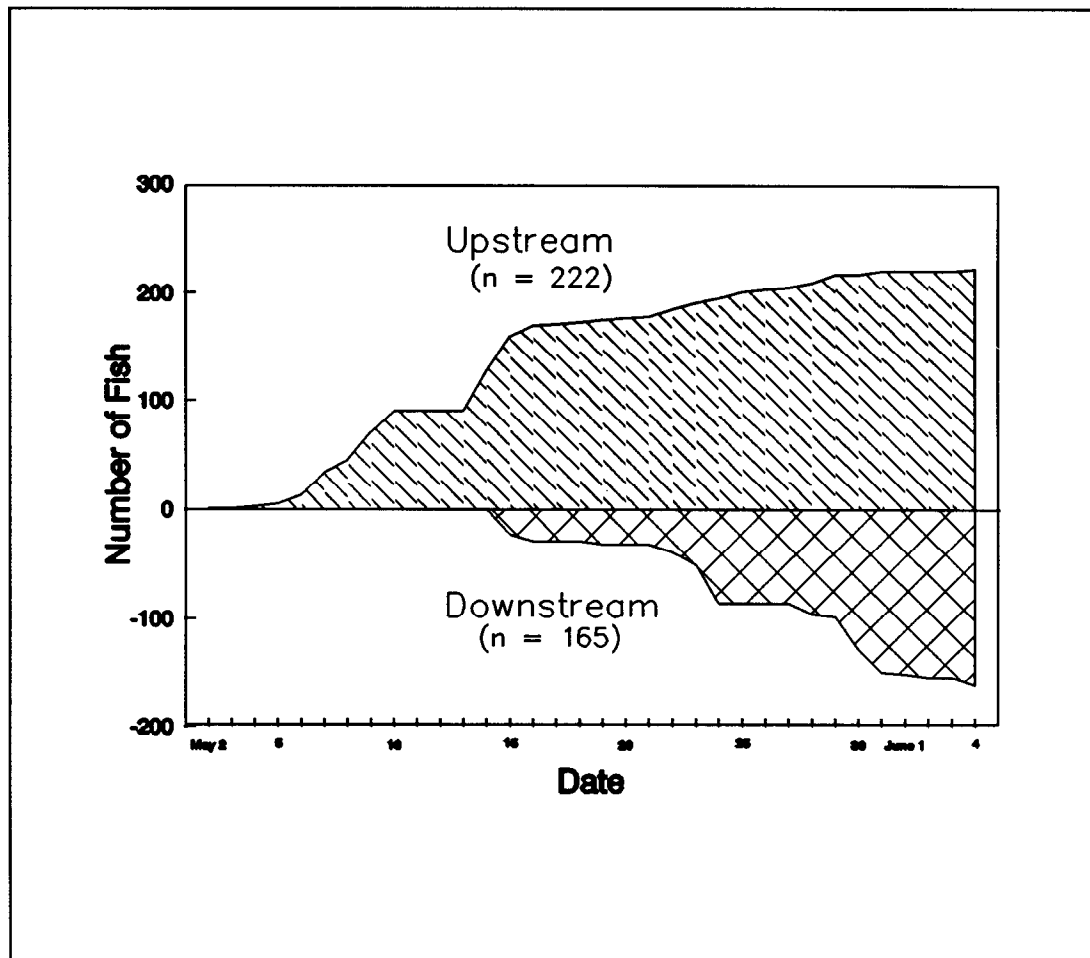


Figure 2. Cumulative numbers of steelhead migrating through the Peterson Creek weir, 1989.

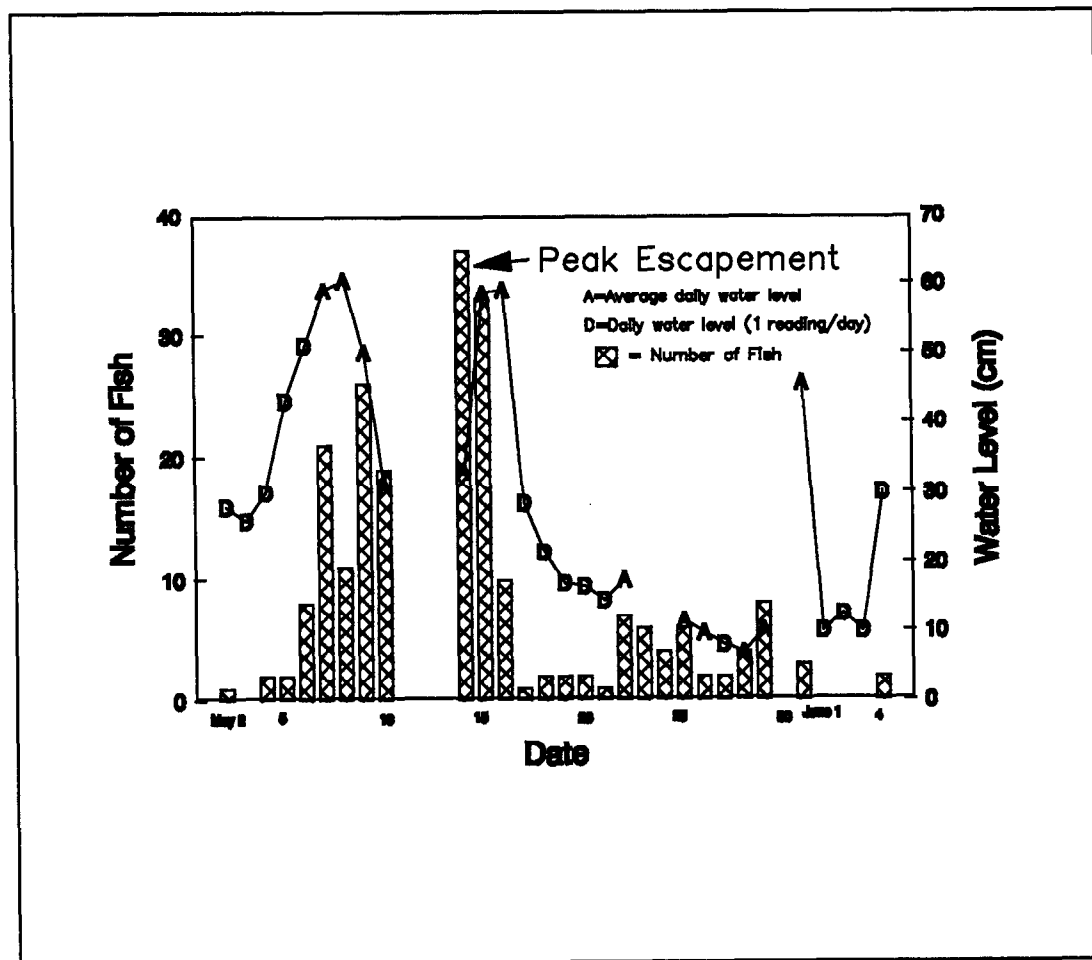


Figure 3. Histogram of Peterson Creek steelhead escapement counts in 1989 and average daily water levels.

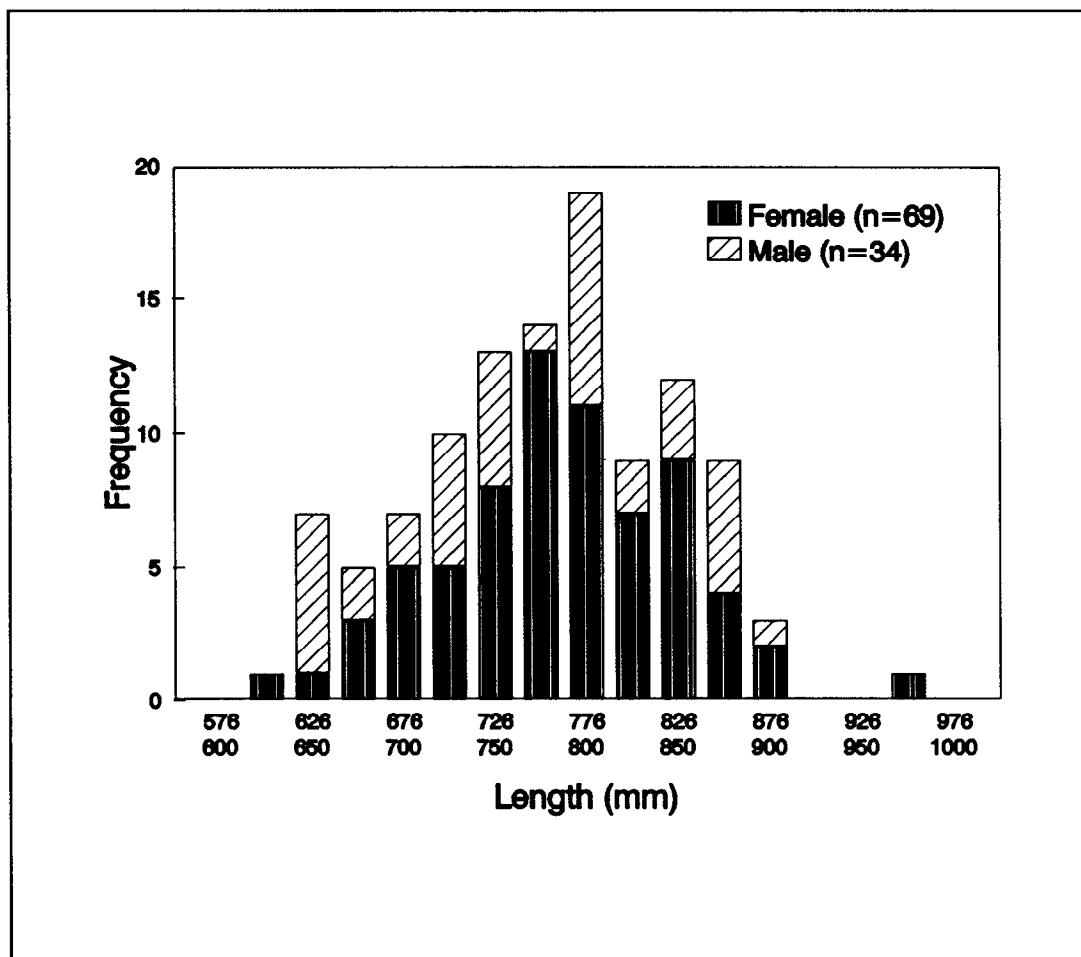


Figure 4. Length frequency distributions of male and female steelhead migrating upstream through the Peterson Creek weir, 1989.

Table 3. Steelhead length, weight and condition factors (K-factor) in the weir and creel survey sampling at Peterson Creek in 1989.

	<u>Weir</u>		<u>Creel Survey</u>	
	Female	Male	Female	Male
Mean Length (cm)	776	762	786	746
n=	69	34	3	8
SE=	1.0	2.2	17	10
Mean Weight (gm)	4732	4505	3886	3216
n=	69	34	2	6
SE=	19	36	505	151
K-Factor ^a	1.01	0.99	0.90	0.90
n=	69	34	2	6
SE=	0.0022	0.0025	0.0499	0.0106

^a $K = 1,000 \times \text{Weight (gm)} / \text{Fork Length (cm)}^3$

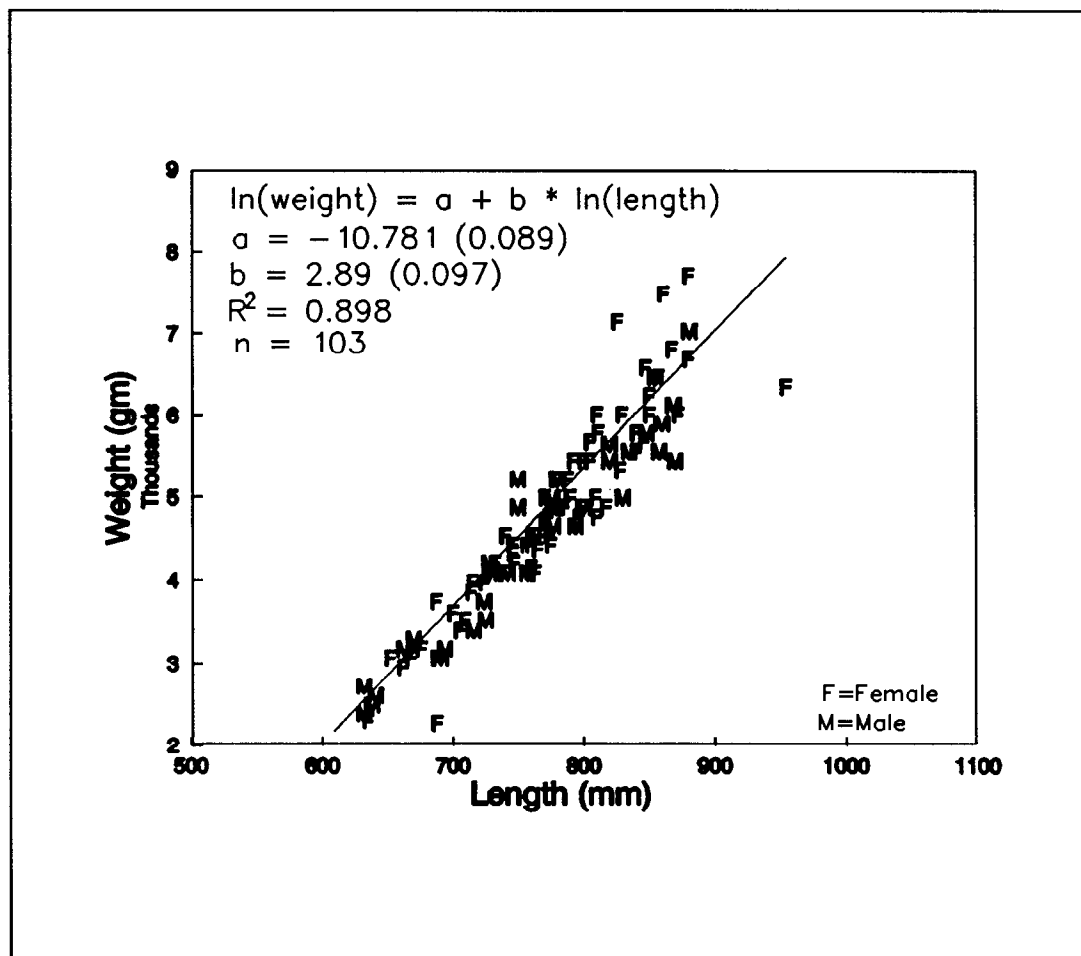


Figure 5. Length versus weight of steelhead migrating upstream through the Peterson Creek weir, 1989.

The ages of fish sampled at Peterson Creek during 1989 have not been determined. Age composition and age-weight-length relationships will be reported in subsequent years.

Harvest Studies

The sport fishery on Peterson Creek did not begin as early as we expected in 1989, possibly as a result of cold weather and ice conditions. Periodic checks of Peterson Creek between March 15 and April 7 revealed very little angler effort and only two interviews were conducted. Prior to April 7, anglers fished mostly at the stream mouth in saltwater. The formal harvest survey was conducted from April 7 through June 4. A total of 371 angler interviews were conducted, and 218 anglers were observed fishing during our "instantaneous" angler counts. During our interview samples, we observed 6 steelhead kept and another 4 released (Table 4). As expected, most interviews were incomplete and showed CPUE to be 0.0. The independent surplus T-test showed no significant difference in CPUE between the two interview types ($p=0.84$).

An estimated total of 2,121 angler hours ($SE=200$) were spent in the Peterson Creek system during our study. The total estimated catch of steelhead was 39 fish, or 17.7% of the total run. Of the total catch, 22 ($SE=7.35$) steelhead were kept or harvested and 17 ($SE=15.6$) were released (Table 5). We were able to weigh and measure 7 harvested fish (3 of which were not encountered during scheduled creel samples) in the angler harvest (Table 3). About half of the fish we observed in the angler harvest had spawned, resulting in lower weights and condition factors than weir sampled fish (Table 3).

Other fish caught in the angler creel are summarized in Table 5, and include Dolly Varden, cutthroat trout *O. clarki* and rainbow trout. Dolly Varden were the most numerous in the angler creel with a total catch of 638 fish, of which only 181 ($SE=42.0$) were kept and 457 ($SE=214$) were released. The cutthroat trout catch totaled 212 ($SE=171$) fish and all of these were released. A total of 32 rainbow trout (or steelhead pre-smolt) were caught, with 10 ($SE=4.1$) kept or harvested and 22 ($SE=21.7$) released.

Angler effort was concentrated at the lagoon outlet in saltwater (212 angler-hours of observed effort), but we observed no steelhead caught there (Appendix A4). The entire lagoon area was the second most popular fishing site (115.5 angler-hours) followed by the area upstream of the Glacier Highway Bridge (101.25 angler-hours). Steelhead were observed caught only at the mouth of the salt lagoon in saltwater (1 steelhead) and above the Glacier Highway Bridge (9 steelhead).

The observed effort was generally well divided between completed-trip and incomplete-trip angler interviews, and there was very little difference in angler effort observed between weekday and weekend (Appendix A5). Of the 6 steelhead harvested, 4 were from completed-trip anglers while 2 were from incomplete-trip anglers.

Table 4. Summary of observed creel survey data from Peterson Creek, 1989.

Bi-weekly Period		Number ^a of Samples	Number ^b Anglers Counted	Number Anglers Interviewed	Effort (Angler- Hours)	Steelhead		Dolly Varden		Cutthroat Trout		Rainbow Trout	
Begin	End					Kept	Released	Kept	Released	Kept	Released	Kept	Released
27-Mar-89	09-Apr-89												
Weekday		2	7	4	4.00	0	0	0	0	0	0	0	0
Weekend-Holiday		4	6	4	1.25	0	0	0	0	0	0	0	0
Total		6	13	8	5.25	0	0	0	0	0	0	0	0
10-Apr-89	23-Apr-89												
Weekday		11	15	22	25.75	0	0	3	14	0	0	0	0
Weekend-Holiday		6	12	24	31.50	0	0	16	14	0	0	1	0
Total		17	27	46	57.25	0	0	19	28	0	0	1	0
24-Apr-89	07-May-89												
Weekday		12	33	55	107.50	1	0	14	6	0	0	0	0
Weekend-Holiday		8	38	61	80.00	1	0	10	51	0	0	0	0
Total		20	71	116	187.50	2	0	24	57	0	0	0	0
08-May-89	21-May-89												
Weekday		12	22	41	57.25	1	3	2	18	0	0	0	0
Weekend-Holiday		8	52	93	167.50	2	1	0	10	0	2	0	0
Total		20	74	134	224.75	3	4	2	28	0	2	0	0
22-May-89	04-Jun-89												
Weekday		10	20	34	54.25	1	0	0	1	0	1	0	4
Weekend-Holiday		10	13	33	34.50	0	0	4	0	0	12	2	0
Total		20	33	67	88.75	1	0	4	1	0	13	2	4
Season Totals		83	218	371	563.50	6	4	49	114	0	15	3	4

^a each sample= 2 hours in length

^b Instantaneous angler counts

Table 5. Summary of expanded creel survey point estimates and confidence limits (CI) from Peterson Creek, 1989.

		Approximate 95% Lower CI Limit	Point Estimate	Approximate 95% Upper CI Limit	SE
Angler Effort (Angler-hours)		1,722	2,121	2,521	200.
Steelhead:	Kept	7	22	37	7.35
	Released	4	17	48	15.6
Dolly Varden:	Kept	97	181	265	42.0
	Released	114	457	884	214.
Cutthroat Trout:	Kept	0	0	0	0.0
	Released	45	212	555	171.
Rainbow Trout:	Kept	3	10	18	4.12
	Released	4	22	65	21.7

DISCUSSION

The timing of the steelhead escapement at Peterson Creek in 1989 is very similar to the combined Sitkoh Creek 1936, 1937 and 1982 steelhead escapement (Schmidt 1985), and also similar to the late run Karta River steelhead in 1989 (Steve Hoffman, ADF&G, Division of Sport Fish, 2030 Sea Level Drive, Ketchikan AK, 99901, personal communication)(Figure 6). The Peterson Creek steelhead length/weight relationship is also very similar to that obtained in 1982 for Sitkoh Creek steelhead (Figure 7).

The number of steelhead returning to Peterson Creek was not large, at only 222 adults, but it did attract many anglers. The level of effort (2,121 angler hours) for an estimated catch of 39 steelhead (0.02 steelhead/hour or 1 steelhead for 54 hours of fishing) is very low. Compared to other streams in southeast Alaska, the catch rate of 0.02 steelhead/hour at Peterson Creek is the lowest, with other streams ranging from a high of 0.40 steelhead/hour (Situk River) to 0.07 steelhead/hour (Thorne River) (Table 6). The reason for the low catch rate at Peterson is unclear, but we believe it is due to a high percentage of inexperienced anglers participating in the fishery. For many anglers, Peterson Creek is their first experience with fishing for steelhead.

Management proposals in the next few years may need to consider catch and release regulations for Peterson Creek if anglers improve their fishing skills and more fish are harvested. The ratio of released to kept steelhead (1.27) at Peterson Creek is one of the lowest in the southeast Alaska, indicating that of those fish caught a higher percentage are kept than at most other southeast locations (Table 6). Another management option that is currently being explored is a steelhead stocking program on the Juneau roadside (Schwan 1990) to provide additional fishing opportunities for steelhead anglers, and provide a harvest area should Peterson Creek become catch and release only.

The use pattern observed during 1989 at Peterson Creek may not reflect historical patterns. We believe that there was an increase in angler effort at Peterson Creek as a result of our weir, as more people became aware of this local steelhead resource. There also was probably a shift in the angler effort from upstream sites to downstream sites at the salt lagoon outlet, in both fresh and saltwater. A sign posted above the weir provided information about the project and listed the cumulative number of steelhead which had been passed upstream through the weir. Anglers concentrated their efforts at the salt lagoon outlet and did not fish above the weir until several fish had been passed upstream.

The Peterson Creek steelhead project is to be continued for the next four years (1990-1994). Future work will monitor escapements and harvests, age-weight-length relationships, and tag juvenile rainbow trout to determine if smolt originating above the barrier falls contribute to the adult recruitment below the falls.

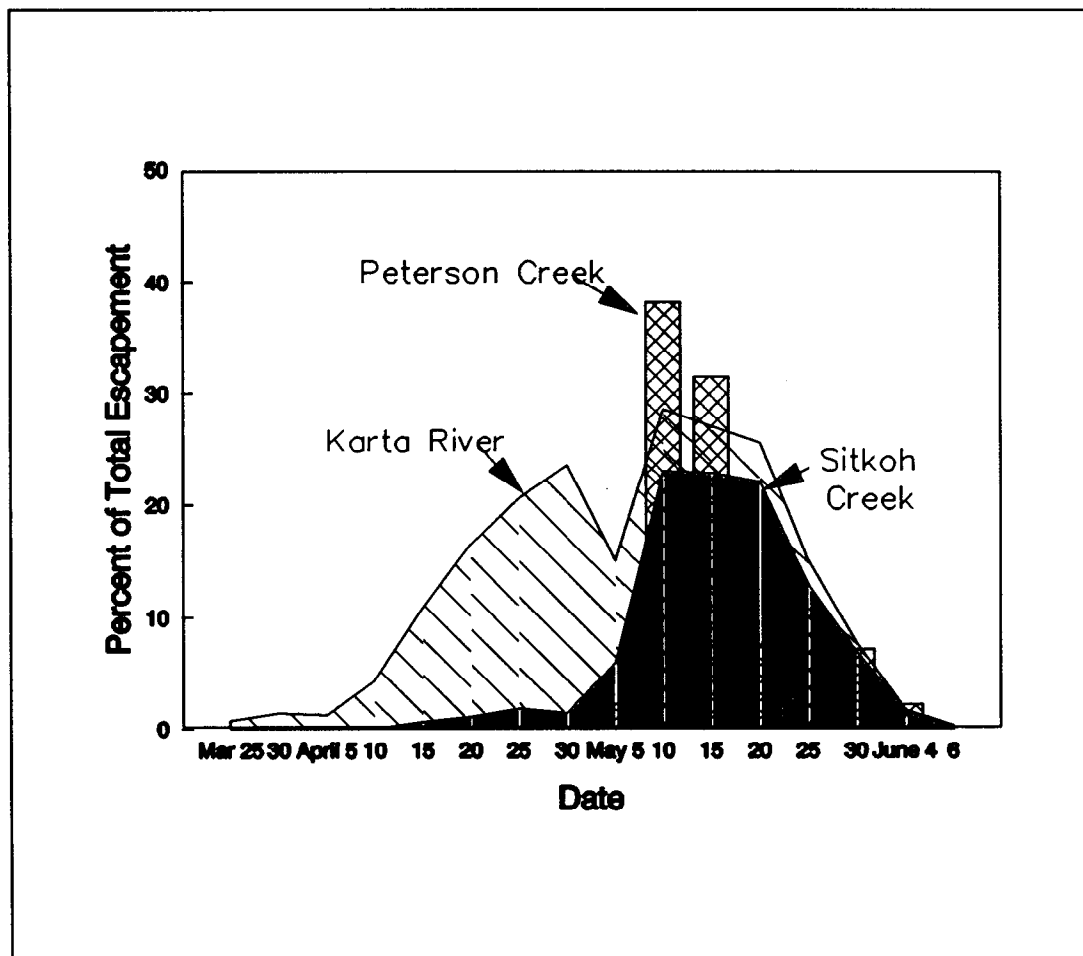


Figure 6. Cumulative percent of total escapement of steelhead past the Peterson Creek weir in 1989; the combined 1936, 1937, and 1982 Sitkoh Creek weir escapement (Schmidt 1985); and the Karta River weir escapement in 1989 (Steve Hoffman, ADF&G, Division of Sport Fish, Ketchikan AK, personal communication).

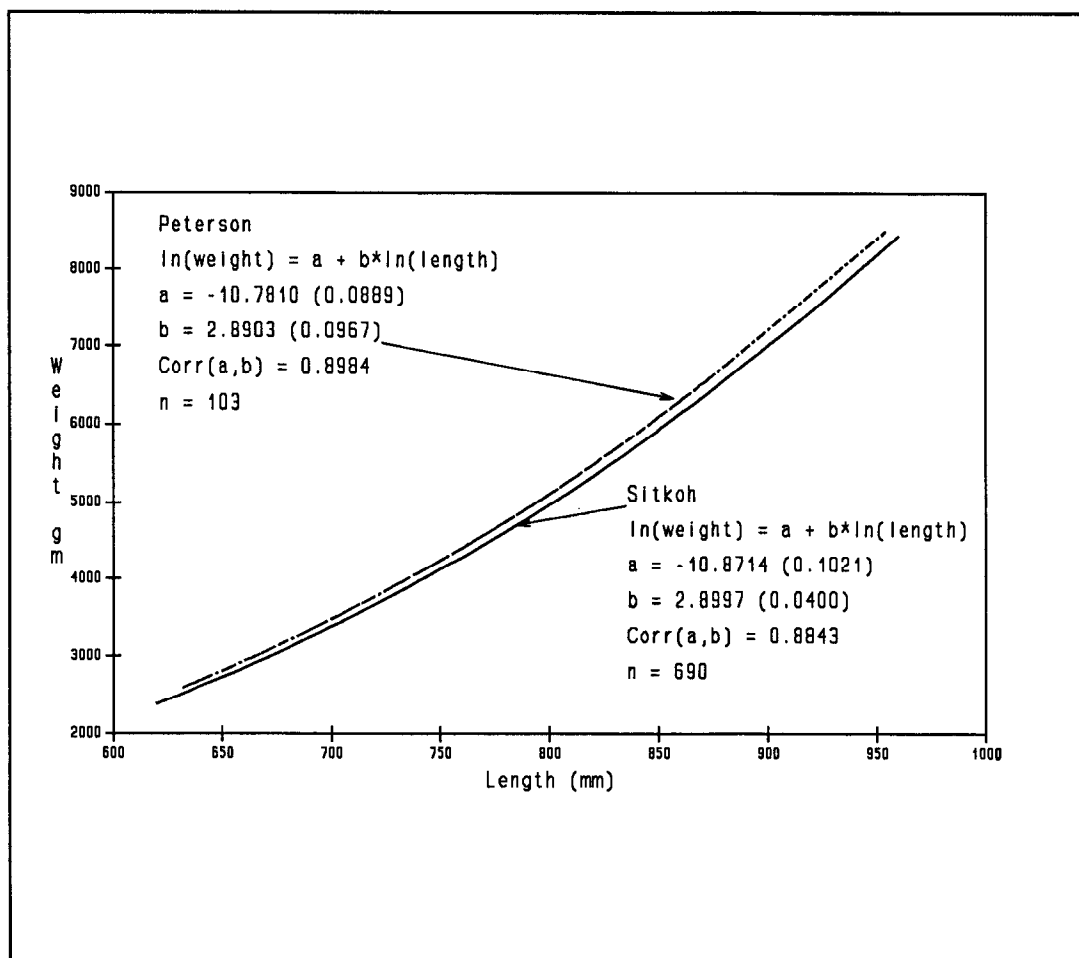


Figure 7. Length-weight relationships of the 1989 Peterson Creek steelhead and the 1982 Sitkoh Creek steelhead.

Table 6. Comparison of steelhead catch rates in selected streams in southeast Alaska, 1985 - 1989.

Year	Location	Effort	Steelhead		CPUE	Ratio Released to Kept
			Kept	Released		
1985 ^a	Situk	12,664	428	4,584	0.40	10.7
1986 ^a	Situk	12,283	287	2,094	0.19	7.3
1987 ^a	Situk	10,542	391	3,791	0.40	9.7
1988 ^a	Situk	16,379	423	4,991	0.33	11.8
1989 ^b	Situk	10,988	361	2,055	0.22	5.7
1988 ^c	Thorne	2,331	67	93	0.07	1.4
1988 ^d	Ward	4,720	395	305	0.15	0.8
1989 ^e	Karta	1,568	50	124	0.11	2.5
1989	Peterson	2,121	22	17	0.02	0.8

^a Suchanek and Bingham 1989

^b Bob Johnson, ADF&G, Division of Sport Fish, Yakutat, AK, personal communication

^c Freeman and Hoffman 1990 (September 26, 1988 through June 4, 1989)

^d Hubbartt 1990 (October 10, 1988 through May 21, 1989)

^e Hoffman et al. 1990

ACKNOWLEDGEMENTS

We thank local property owners Walter E. Butts, Jr. and Mrs. Jeannie B. Moulds, who allowed us to place part of our weir on their property. We also thank the City and Borough of Juneau for allowing us to locate part of our weir and a tent camp on their property. Invaluable assistance was provided by project technicians, Kurt Kondzela and Dave Standlea. Allen Bingham wrote the SAS program to calculate the creel estimates

LITERATURE CITED

- Cochran, W. G. 1977. Sampling techniques. John Wiley and Sons, New York, New York, USA.
- Freeman, G. M., and S. H. Hoffman. 1990. Steelhead *Oncorhynchus mykiss* creel census and recreation survey on the Thorne River, southeast Alaska, 1988 - 89. Alaska Department of Fish and Game, Division of Sport Fish. *In press*.
- Goodman, L. A. 1960. On the exact variance of products. Journal of the American Statistical Association 55:708-713.
- Gunstrom, G., and M. Bethers. 1985. Electrical anesthesia for handling large salmonids. The Progressive Fish-Culturist 47:67-69.
- Hoffman, S. H., J. Koerner, and D. Magnus. 1990. Steelhead creel and escapement statistics, in-river distribution, and recreational use survey, Karta River, southeast Alaska, 1989. Alaska Department of Fish and Game, Division of Sport Fish. *In press*.
- Hubbartt, D. 1990. Ward Creek steelhead creel survey, Ketchikan, Alaska, 1989. Alaska Department of Fish and Game, Division of Sport Fish. *In press*.
- Jessen, R. J. 1978. Statistical survey techniques. John Wiley and sons, New York, New York, USA.
- Neter, J., and W. Wasserman. 1974. Applied Linear Statistical Models, Regression, Analysis of variance, and experimental designs. Irwin-Dorsey Limited, Georgetown, Ontario.
- Neuhold, J. M., and K. H. Lu. 1957. Creel census method. Utah State Department of Fish and Game Publication 8, Salt Lake City, Utah, USA.
- Schmidt, A. E. 1985. Sitkoh Creek Steelhead. In Alaska Steelhead Workshop 1985. Alaska Department of Fish and Game, Division of Sport Fish. 134 pp.
- Schwan, M. 1990. Strategic plans for the Juneau, Ketchikan, and Sitka recreational fisheries. Alaska Department of Fish and Game, Division of Sport Fish. 63 pp.

LITERATURE CITED (Continued)

- Suchanek, P. M., and A. E. Bingham. 1989. Harvest estimates for selected sport fisheries in southeast Alaska in 1988. Alaska Department of Fish and Game, Division of Sport Fish. Fisheries Data Series No. 114. 120 pp.
- Von Geldern, C. E., Jr., and P. K. Tomlinson. 1973. On the analysis of angler catch rate data from warmwater reservoirs. California Fish and Game 59:281-292.

APPENDIX A

Appendix A1. Daily upstream steelhead counts at Peterson Creek weir, 1989.

Date	Time	Upstream		Sampled	Cum. Sampled	Water Temp (°C)	Water Level (cm)	Weather
		Count	Cumulative					
02-May-89	21:00	1	1		0	5.0	28.0	Clear
03-May-89			1		1	3.0	28.0	Cloudy
04-May-89	08:00	2	3	2	2	8.0	26.0	Cloudy
05-May-89	20:15	2	5	2	4	4.0	30.0	Rain
06-May-89	23:50	8	13		4	4.0	43.0	Rain
07-May-89	09:15	2	15	2	6	4.0	51.0	Rain
07-May-89	16:30	5	20	5	11	4.5	60.0	Rain
07-May-89	20:15	6	26	6	17	4.5	61.0	Rain
07-May-89	23:15	8	34		17	4.0	64.0	Rain
08-May-89	03:00	3	37		17	4.0	69.0	Rain
08-May-89	10:00	5	42	5	22	4.5	63.5	Cloudy
08-May-89	13:45	1	43		22	5.0	59.0	Partly Cloudy
08-May-89	16:30	1	44	1	23	4.5	57.0	Cloudy
08-May-89	20:40	1	45	1	24	5.0	53.5	Cloudy
09-May-89	13:00	10	55		24	5.0	52.0	Rain
09-May-89	16:00	6	61	6	30	5.5	53.0	Partly Cloudy
09-May-89	21:00	4	65	4	34	5.5	49.0	Clear
09-May-89	23:30	6	71		34	5.0	46.0	Clear
10-May-89	14:30	1	72	1	35	6.0	32.5	Clear
10-May-89	15:40	1	73	1	36	6.0	32.5	Clear
10-May-89	18:30	8	81	8	44	6.0	30.0	Clear
10-May-89	23:30	9	90		44	6.0	28.5	Partly Cloudy
14-May-89	08:00	16	106	4	48	5.5	28.5	Rain
14-May-89	13:20	6	112	5	53	6.5	30.5	Rain & Wind
14-May-89	23:00	15	127	10	63	6.0	40.0	Cloudy
15-May-89	08:00	16	143	15	78	6.0	57.5	Rain
15-May-89	14:30	3	146		78			Partly Cloudy
15-May-89	16:50	2	148		78			Partly Cloudy
15-May-89	18:15	3	151		78			Partly Cloudy
15-May-89	21:00	5	156		78			Partly Cloudy
15-May-89	22:30	4	160		78			Partly Cloudy
16-May-89	18:30	5	165		78	5.0	58.5	Rain
16-May-89	22:00	5	170	5	83	5.5	59.5	Cloudy
17-May-89	20:20	1	171	1	84	7.0	28.5	Clear
18-May-89	22:30	2	173		84	7.0	21.5	Partly Cloudy
19-May-89	23:35	2	175		84	6.8	17.0	Partly Cloudy
20-May-89	08:45	2	177	2	86	6.0	16.5	Mostly Cloudy
21-May-89	10:00	1	178	1	87	7.0	14.5	Clear
22-May-89	10:15	1	179	1	88	8.5	17.5	Rain
22-May-89	18:35	2	181		88			Cloudy
22-May-89	23:20	4	185		88			Partly Cloudy
23-May-89	09:15	6	191		88			Rain
24-May-89	12:30	1	192		88			Rain
24-May-89	22:00	3	195		88			Partly Cloudy
25-May-89	10:00	5	200	5	93	9.0	12.0	Partly Cloudy
25-May-89	17:05	1	201	1	94	13.0	11.0	Partly Cloudy
26-May-89	08:30	1	202	1	95	9.0	10.0	High Overcast
26-May-89	14:30	1	203	1	96	11.0	9.5	Clear
27-May-89	12:00	2	205	2	98	11.0	8.0	Clear
28-May-89	08:15	2	207	2	100	10.0	7.0	High Overcast
28-May-89	12:30	1	208	1	101	10.5	7.0	High Overcast
28-May-89	19:30	1	209		101	11.5	6.5	High Overcast
29-May-89	08:30	1	210	1	102	11.5	6.0	Cloudy
29-May-89	16:55	1	211	1	103	12.0	6.0	High Overcast
29-May-89	21:30	2	213		103		6.0	Partly Cloudy
29-May-89	22:30	1	214		103		6.0	Partly Cloudy
29-May-89	16:45	1	215		103	11.5	14.0	Rain
29-May-89	19:45	1	216		103	11.5	16.5	Cloudy
29-May-89	21:20	1	217	1	104	11.5	16.5	Rain
31-May-89	08:00	1	218		104	11.0	40.0	Rain
31-May-89	10:30	2	220		104	15.0	51.0	Clearing
01-Jun-89			220		104	11.0	10.0	Clear
02-Jun-89	14:00		220		104		12.5	Clear
03-Jun-89	23:00		220		104		10.0	Rain
04-Jun-89	10:00	2	222		104		30.0	Rain

Appendix A2. Length, weight, condition factor (K-factor), and sex of Peterson Creek steelhead trout and Dolly Varden, by sample type and date, 1989.

Date	Sample Type	Species	Length	Weight	K-factor	Sex
14 APR 89	Creel Census	Dolly Varden	305	220	0.77540	NA
14 APR 89	Creel Census	Dolly Varden	368	320	0.64211	NA
15 APR 89	Creel Census	Dolly Varden	255	150	0.90463	NA
15 APR 89	Creel Census	Dolly Varden	315	240	0.76786	NA
15 APR 89	Creel Census	Dolly Varden	260	145	0.82499	NA
15 APR 89	Creel Census	Dolly Varden	245	110	0.74799	NA
15 APR 89	Creel Census	Dolly Varden	388	440	0.75328	NA
15 APR 89	Creel Census	Dolly Varden	350	350	0.81633	NA
15 APR 89	Creel Census	Dolly Varden	325	100	0.29131	NA
15 APR 89	Creel Census	Dolly Varden	334	250	0.67097	NA
15 APR 89	Creel Census	Dolly Varden	260	200	1.13792	NA
15 APR 89	Creel Census	Dolly Varden	263	200	1.09942	NA
17 APR 89	Creel Census	Dolly Varden	248	110	0.72117	NA
23 APR 89	Creel Census	Dolly Varden	255	140	0.84432	NA
23 APR 89	Creel Census	Dolly Varden	264	160	0.86958	NA
23 APR 89	Creel Census	Steelhead	254	130	0.79331	NA
23 APR 89	Creel Census	Dolly Varden	356	260	0.57627	NA
27 APR 89	Creel Census	Dolly Varden	360	300	0.64300	NA
29 APR 89	Creel Census	Dolly Varden	475	900	0.83977	NA
29 APR 89	Creel Census	Dolly Varden	317	290	0.91037	NA
30 APR 89	Creel Census	Steelhead	780	4100	0.86397	M
01 MAY 89	Creel Census	Dolly Varden	302	210	0.76243	NA
01 MAY 89	Creel Census	Dolly Varden	330	300	0.83479	NA
01 MAY 89	Creel Census	Dolly Varden	391	510	0.85318	M
01 MAY 89	Creel Census	Steelhead	788	4600	0.94011	F
02 MAY 89	Weir	Steelhead	875	NA	NA	F
03 MAY 89	Creel Census	Steelhead	705	3000	0.85616	M
04 MAY 89	Creel Census	Steelhead	787	4533	0.92995	M
04 MAY 89	Weir	Steelhead	750	5217	1.23662	M
04 MAY 89	Weir	Steelhead	635	2295	0.89632	F
05 MAY 89	Weir	Steelhead	765	4504	1.00604	NA
05 MAY 89	Weir	Steelhead	765	4363	0.97454	F
07 MAY 89	Weir	Steelhead	770	4703	1.03016	F
07 MAY 89	Weir	Steelhead	870	5439	0.82596	M
07 MAY 89	Weir	Steelhead	820	5439	0.98646	M
07 MAY 89	Weir	Steelhead	780	4873	1.02686	M
07 MAY 89	Weir	Steelhead	858	5552	0.87900	M
07 MAY 89	Weir	Steelhead	805	5439	1.04263	F
07 MAY 89	Weir	Steelhead	728	4079	1.05721	M
07 MAY 89	Weir	Steelhead	778	4873	1.03480	F
07 MAY 89	Weir	Steelhead	632	2720	1.07750	M
07 MAY 89	Weir	Steelhead	811	5779	1.08340	F
07 MAY 89	Weir	Steelhead	740	4533	1.11864	F

- (Continued) -

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Date	Sample Type	Species	Length	Weight	K-factor	Sex
07 MAY 89	Weir	Steelhead	694	3173	0.94927	M
07 MAY 89	Weir	Steelhead	881	7026	1.02750	M
08 MAY 89	Weir	Steelhead	794	4646	0.92815	M
08 MAY 89	Weir	Steelhead	776	4986	1.06701	M
08 MAY 89	Weir	Steelhead	855	6459	1.03340	M
08 MAY 89	Weir	Steelhead	880	7705	1.13064	F
08 MAY 89	Weir	Steelhead	724	3966	1.04505	F
08 MAY 89	Weir	Steelhead	785	4873	1.00737	F
08 MAY 89	Weir	Steelhead	724	3739	0.98523	M
09 MAY 89	Weir	Steelhead	745	4419	1.06870	F
09 MAY 89	Weir	Steelhead	760	4136	0.94219	F
09 MAY 89	Weir	Steelhead	700	3598	1.04898	F
09 MAY 89	Weir	Steelhead	800	4873	0.95176	F
09 MAY 89	Weir	Steelhead	880	6686	0.98111	F
09 MAY 89	Weir	Steelhead	820	5637	1.02237	M
09 MAY 89	Weir	Steelhead	867	6799	1.04325	F
09 MAY 89	Weir	Steelhead	790	4986	1.01128	F
09 MAY 89	Weir	Steelhead	638	2493	0.95998	M
09 MAY 89	Weir	Steelhead	715	3966	1.08501	F
10 MAY 89	Weir	Steelhead	830	4986	0.87200	M
10 MAY 89	Weir	Steelhead	860	5892	0.92633	M
10 MAY 89	Weir	Steelhead	760	4533	1.03263	F
10 MAY 89	Weir	Steelhead	670	3286	1.09255	M
10 MAY 89	Weir	Steelhead	829	6006	1.05420	F
10 MAY 89	Weir	Steelhead	809	4986	0.94169	F
10 MAY 89	Weir	Steelhead	775	4419	0.94933	F
10 MAY 89	Weir	Steelhead	662	2946	1.01545	F
10 MAY 89	Weir	Steelhead	742	4079	0.99849	M
10 MAY 89	Weir	Steelhead	705	3399	0.97003	F
10 MAY 89	Weir	Steelhead	850	6232	1.01478	F
10 MAY 89	Weir	Steelhead	738	4079	1.01481	F
10 MAY 89	Weir	Steelhead	757	4079	0.94030	M
10 MAY 89	Weir	Steelhead	770	4986	1.09214	F
13 MAY 89	Creel Census	Steelhead	650	2266	0.82513	M
14 MAY 89	Weir	Steelhead	760	4419	1.00666	F
14 MAY 89	Weir	Steelhead	687	3739	1.15315	F
14 MAY 89	Weir	Steelhead	750	4873	1.15508	M
14 MAY 89	Weir	Steelhead	641	2606	0.98946	M
14 MAY 89	Weir	Steelhead	869	6119	0.93244	M
14 MAY 89	Weir	Steelhead	810	4759	0.89549	F
14 MAY 89	Weir	Steelhead	773	4759	1.03033	F
14 MAY 89	Weir	Steelhead	709	3513	0.98569	F
14 MAY 89	Weir	Steelhead	850	6006	0.97798	F

- (Continued) -

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Date	Sample Type	Species	Length	Weight	K-factor	Sex
14 MAY 89	Weir	Steelhead	714	3853	1.05853	F
14 MAY 89	Weir	Steelhead	848	5779	0.94769	M
14 MAY 89	Weir	Steelhead	756	4419	1.02272	F
14 MAY 89	Weir	Steelhead	828	5326	0.93823	F
14 MAY 89	Weir	Steelhead	800	4873	0.95176	M
14 MAY 89	Weir	Steelhead	668	3059	1.02624	F
15 MAY 89	Weir	Steelhead	840	5552	0.93672	F
15 MAY 89	Weir	Steelhead	861	7479	1.17175	F
15 MAY 89	Weir	Steelhead	769	4533	0.99680	F
15 MAY 89	Weir	Steelhead	788	5212	1.06519	F
15 MAY 89	Weir	Steelhead	857	6459	1.02618	F
15 MAY 89	Weir	Steelhead	716	3399	0.92600	M
15 MAY 89	Weir	Steelhead	746	4419	1.06441	F
15 MAY 89	Weir	Steelhead	792	5439	1.09482	F
15 MAY 89	Weir	Steelhead	728	4193	1.08675	M
15 MAY 89	Weir	Steelhead	691	3059	0.92714	M
15 MAY 89	Weir	Steelhead	789	4986	1.01513	F
15 MAY 89	Weir	Steelhead	774	4533	0.97760	F
15 MAY 89	Weir	Steelhead	780	5212	1.09830	M
15 MAY 89	Weir	Steelhead	826	7139	1.26677	F
15 MAY 89	Weir	Steelhead	780	5212	1.09830	F
16 MAY 89	Weir	Steelhead	810	6006	1.13013	F
16 MAY 89	Weir	Steelhead	747	4193	1.00592	F
16 MAY 89	Weir	Steelhead	835	5552	0.95365	M
16 MAY 89	Weir	Steelhead	840	5779	0.97502	F
16 MAY 89	Weir	Steelhead	817	4873	0.89357	F
17 MAY 89	Weir	Steelhead	687	3059	0.94343	F
17 MAY 89	Creel Census	Steelhead	640	2500	0.95367	M
17 MAY 89	Creel Census	Steelhead	835	.	.	F
20 MAY 89	Weir	Steelhead	800	5439	1.06230	F
20 MAY 89	Weir	Steelhead	846	5666	0.93576	F
20 MAY 89	Creel Census	Steelhead	718	2900	0.78347	M
21 MAY 89	Weir	Steelhead	764	4533	1.01650	F
25 MAY 89	Weir	Steelhead	796	4759	0.94358	F
25 MAY 89	Weir	Steelhead	676	3173	1.02714	F
25 MAY 89	Weir	Steelhead	732	4193	1.06903	F
25 MAY 89	Weir	Steelhead	847	6572	1.08155	F
25 MAY 89	Weir	Steelhead	652	3059	1.10366	F
25 MAY 89	Weir	Steelhead	777	4646	0.99041	M
26 MAY 89	Weir	Steelhead	954	6346	0.73089	F
26 MAY 89	Weir	Steelhead	763	4079	0.91829	F
27 MAY 89	Weir	Steelhead	688	2266	0.69582	F
27 MAY 89	Weir	Steelhead	805	5666	1.08615	F

- (Continued) -

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Date	Sample Type	Species	Length	Weight	K-factor	Sex
28 MAY 89	Weir	Steelhead	632	2380	0.94281	M
28 MAY 89	Weir	Steelhead	725	3513	0.92186	M
28 MAY 89	Weir	Steelhead	609	2153	0.95322	F
29 MAY 89	Weir	Steelhead	872	6006	0.90581	F
29 MAY 89	Weir	Steelhead	663	3173	1.08875	M
29 MAY 89	Weir	Steelhead	746	4306	1.03719	F
29 MAY 89	Creel Census	Steelhead	870	.	.	M
29 MAY 89	Creel Census	Steelhead	825	.	.	M
29 MAY 89	Creel Census	Steelhead	735	3173	0.79911	F

Appendix A3. Daily downstream steelhead counts at Peterson Creek weir, 1989.

Date	Time	Downstream		Water Temp. (°C)	Water Level (cm)	Weather
		Count	Cumulative			
15-May-89	14:20	6	6			Partly Cloudy
15-May-89	17:45	10	16			Partly Cloudy
15-May-89	21:00	2	18			Partly Cloudy
15-May-89	22:30	5	23			Partly Cloudy
15-May-89	13:15	4	27			Rain, Windy
16-May-89	22:00	2	29	5.5	59.5	Cloudy
19-May-89	22:30	3	32	7.0	21.5	Partly Cloudy
22-May-89	18:35	6	38			Cloudy
22-May-89	23:20	1	39			Partly Cloudy
23-May-89	09:15	8	47			Rain
23-May-89	17:05	4	51			Cloudy
24-May-89	13:00	15	66			Rain
24-May-89	22:00	20	86			Partly Cloudy
28-May-89	07:30	5	91			High Overcast
28-May-89	10:30	1	92	10.0	7.0	High Overcast
28-May-89	19:30	4	96	11.5	6.5	High Overcast
29-May-89	22:30	2	98		6.0	Partly Cloudy
30-May-89	08:30	10	108	11.0	9.0	Rain
30-May-89	13:15	15	123		11.5	Drizzle
30-May-89	16:45	6	129	11.5	14.0	Cloudy, Drizzle
31-May-89	08:00	15	144	11.0	40.0	Rain
31-May-89	10:30	3	147		51.0	Clearing
31-May-89	18:30	3	150		49.0	Partly Cloudy
01-Jun-89	10:00	2	152	9.5	31.0	Cloudy
02-Jun-89	09:30	1	153		16.5	Clear
02-Jun-89	14:00	1	154	15.0	12.5	Clear
03-Jun-89		0	154		10.0	Rain
04-Jun-89	07:45	5	159		26.5	Rain
04-Jun-89	11:45	2	161		35.5	Rain
04-Jun-89	12:45	1	162	10.5	36.0	Rain
04-Jun-89	15:45	1	163		38.5	Cloudy
04-Jun-89	19:10	2	165		36.0	Partly Cloudy

Appendix A4. Location of effort and harvest of Peterson Creek
steelhead, 1989.

Location	Effort (hrs)	Steelhead Kept	Steelhead Released
Above Hwy bridge	101.25	4	4
Amalga harbor dock	1.50	0	0
In lake from boat	11.00	0	0
Lagoon area to weir	115.50	0	0
Lagoon outlet (Freshwater)	41.75	0	0
Lagoon outlet (Saltwater)	212.00	2	0
Lagoon area (Fresh and Salt)	12.25	0	0
Weir to highway bridge	64.50	0	0
Other	3.75	0	0

Appendix A5. Effort and harvest for complete and incomplete anglers sampled during the 1989 Peterson Creek steelhead creel census.

Biweekly Period	Type of Fishing Day	Completed or Incomplete	Effort	Steelhead		Dolly Varden		Cutthroat Trout	
				Kept	Released	Kept	Released	Kept	Released
March 27 to April 9	Weekday	Completed	4.00	0.00	0.00	0.00	0.00	0.00	0.00
	Weekend-Holiday	Incomplete	1.25	0.00	0.00	0.00	0.00	0.00	0.00
April 9 to April 23	Weekday	Completed	13.25	0.00	0.00	3.00	10.00	0.00	0.00
	Incomplete	12.50	0.00	0.00	0.00	4.00	0.00	0.00	
	Weekend-Holiday	Completed	18.00	0.00	0.00	6.00	2.00	0.00	0.00
		Incomplete	13.50	0.00	0.00	10.00	12.00	0.00	0.00
April 24 to May 7	Weekday	Completed	59.25	0.00	0.00	10.00	3.00	0.00	0.00
		Incomplete	48.00	1.00	0.00	4.00	3.00	0.00	0.00
	Weekend-Holiday	Completed	45.75	1.00	0.00	8.00	24.00	0.00	0.00
		Incomplete	34.25	0.00	0.00	2.00	27.00	0.00	0.00
May 8 to May 21	Weekday	Completed	30.00	1.00	3.00	0.00	0.00	0.00	0.00
		Incomplete	27.25	0.00	0.00	2.00	18.00	0.00	0.00
	Weekend-Holiday	Completed	117.50	2.00	1.00	0.00	0.00	0.00	0.00
		Incomplete	50.00	0.00	0.00	0.00	10.00	0.00	2.00
May 22 to June 4	Weekday	Completed	26.00	0.00	0.00	0.00	0.00	0.00	0.00
		Incomplete	28.25	1.00	0.00	0.00	1.00	0.00	31.00
	Weekend-Holiday	Completed	17.75	0.00	0.00	3.00	0.00	0.00	10.00
		Incomplete	16.75	0.00	0.00	1.00	0.00	0.00	2.00

